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**PATENT COOPERATION TREATY**

**PCT**

**NOTIFICATION OF THE RECORDING  
OF A CHANGE**

(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

NEOBARD, William, John  
W. H. Beck, Greener & Co.  
7 Stone Buildings  
London WC2A 3SZ  
ROYAUME-UNI

Date of mailing (day/month/year)

12 June 2001 (12.06.01)

Applicant's or agent's file reference

WJN/MFG/P8482GB

International application No.

PCT/GB00/03796

**IMPORTANT NOTIFICATION**

International filing date (day/month/year)

04 October 2000 (04.10.00)

1. The following indications appeared on record concerning:

☐ the applicant

☐ the inventor

☒ the agent

☐ the common representative

Name and Address

NEOBARD, William, John  
Page White & Farrer  
54 Doughty Street  
London WC1N 2LS  
United Kingdom

State of Nationality

State of Residence

Telephone No.

020 7831 7929

Facsimile No.

020 7831 8040

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person

☐ the name

☒ the address

☐ the nationality

☐ the residence

Name and Address

NEOBARD, William, John  
W. H. Beck, Greener & Co.  
7 Stone Buildings  
London WC2A 3SZ  
United Kingdom

State of Nationality

State of Residence

Telephone No.

020 7405 0921

Facsimile No.

020 7405 8113

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

☒ the receiving Office

☐ the International Searching Authority

☐ the International Preliminary Examining Authority

☒ the designated Offices concerned

☐ the elected Offices concerned

☐ other:

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Anman QIU

Telephone No.: (41-22) 338.83.38

004081960

## PATENT COOPERATION TREATY

10/089929

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

To:

McDONOUGH, Johnathan  
Urquhart-Dykes & Lord  
Tower House  
Merrion Way  
Leeds LS2 8PA  
ROYAUME-UNI

Date of mailing (day/month/year) 30 April 2002 (30.04.02)	<b>IMPORTANT NOTIFICATION</b>  International filing date (day/month/year) 09 October 2000 (09.10.00)
Applicant's or agent's file reference P23707A/PPP	
International application No. PCT/GB00/03766	

## 1. The following indications appeared on record concerning:

☐ the applicant
 ☐ the inventor
 ☒ the agent
 ☐ the common representative

## Name and Address

PACITTI, Paolo  
Murgitroyd & Company  
373 Scotland Street  
Glasgow G5 8QA  
United Kingdom

## State of Nationality

## State of Residence

## Telephone No.

0141 307 8400

## Facsimile No.

0141 307 8401

## Teleprinter No.

## 2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person
 ☒ the name
 ☒ the address
 ☐ the nationality
 ☐ the residence

## Name and Address

McDONOUGH, Johnathan  
Urquhart-Dykes & Lord  
Tower House  
Merrion Way  
Leeds LS2 8PA  
United Kingdom

## State of Nationality

## State of Residence

## Telephone No.

44 113 245 2388

## Facsimile No.

44 113 243 0446

## Teleprinter No.

## 3. Further observations, if necessary:

## 4. A copy of this notification has been sent to:

☒ the receiving Office
 ☐ the designated Offices concerned  
☐ the International Searching Authority
 ☒ the elected Offices concerned  
☐ the International Preliminary Examining Authority
 ☐ other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No.: (41-22) 740.14.35	Authorized officer  Lazar Joseph PANAKAL  Telephone No.: (41-22) 338.83.38
---	--

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
 US Department of Commerce  
 United States Patent and Trademark  
 Office, PCT  
 2011 South Clark Place Room  
 CP2/5C24  
 Arlington, VA 22202  
 ETATS-UNIS D'AMERIQUE  
 in its capacity as elected Office

<b>Date of mailing</b> (day/month/year) 13 August 2001 (13.08.01)	
<b>International application No.</b> PCT/GB00/03796	<b>Applicant's or agent's file reference</b> WJN/MFG/P8482GB
<b>International filing date</b> (day/month/year) 04 October 2000 (04.10.00)	<b>Priority date</b> (day/month/year) 04 October 1999 (04.10.99)
<b>Applicant</b> CROSSLAND, William et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

26 April 2001 (26.04.01)

☐ in a notice effecting later election filed with the International Bureau on:
2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Zakaria EL KHODARY Telephone No.: (41-22) 338.83.38
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REC'D 17 DEC 2001

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 102970/PDJ	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB00/03796	International filing date (day/month/year) 04/10/2000	Priority date (day/month/year) 04/10/1999
International Patent Classification (IPC) or national classification and IPC G02F1/1335		
Applicant THOMAS SWAN & CO. LTD. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 7 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand  26/04/2001	Date of completion of this report  13.12.2001
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Noirard, P  Telephone No. +49 89 2399 2420  

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/03796

## I. Basis of the report

1. ~~With regard to the elements of the international application (Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)):~~

**Description, pages:**

1-38 as originally filed

**Claims, No.:**

1-12 as received on 16/11/2001 with letter of 09/11/2001

**Drawings, sheets:**

1-7 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/03796

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Yes:	Claims	2,3,6-11
	No:	Claims	1,4,5,12
Inventive step (IS)	Yes:	Claims	3,6-11
	No:	Claims	2
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations  
**see separate sheet**

## VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

## VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**

**Re l t m V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1.1 Reference is made to the following documents :

**D1:** EP-A-0 878 729 (SHARP KK) 18 November 1998 (1998-11-18)

**D2:** US-A-5 930 012 (MEARS ROBERT JOSEPH ET AL) 27 July 1999

Note: The references in brackets {...} relate to passages in the present application.

2. Objection according to Article 33(2), PCT - Lack of novelty

2.1 Document **D1** teaches an optical device (see the Title) comprising an integrated multiphase spatial light modulator (SLM) (cf. Figs. 7, 8 & 9) for spatial phase modulation (cf. column 10, lines 13-17) of unpolarised light (see the Title), the modulator comprising a substantially planar liquid crystal layer (ref. 18 in Figs. 7-9), a layer reflective of said light (ref. 15 in Figs. 7-9) and a wave-plate layer providing an optical retardance of  $(2n+1)\lambda/4$  (ref. 16 in Figs. 7-9 and col. 7, lines 5-9), wherein said LC layer has two opposed faces (see Fig. 7-9) and is disposed and configured to provide an out of plane tilt in response to a voltage applied between said faces (cf. Fig. 9 and column 10, lines 5-11) and wherein said LC layer (18) is spaced from the reflective layer (15) by the wave plate layer (16, see Figs. 7-9), the SLM comprising an integrated array (cf column 8, lines 53-56) of phase modulating elements (column 10 lines 13-17) and voltage application circuitry (cf. the implicitly present circuitry that provides the voltages V1-V3 in Fig. 9) for applying desired voltage across the LC layer whereby the LC layer has desired values of out of plane tilt (column 10, lines 5-17)

wherein the modulator comprises an array of electrodes (the "reflecting addressing electrodes" 15 in Figs. 7-9 form an array of electrodes), each of the electrodes being associated with a respective portion of the LC layer to define said phase modulating element (see portions 40, 41, 42 in Fig. 9), the electrodes being such that application of voltage to each electrode causes the portion of the LC layer associated with said electrode to have a specific value of said out-of-plane tilt (see Fig.9 and column 10, lines 28-39) and wherein the voltage application circuitry is adapted to apply voltages to said array of electrodes (see Fig.9 and column 10, lines 28-39).

Furthermore, **D1**'s optical device can be used for varying a deflection angle of the light as stated column 10, line 17.

Each feature of claim 1 having a counterpart in **D1**, the subject matter of **claim 1** is not new.

Comment 1 : using **D1**'s device for beam steering is suggested throughout **D1**'s disclosure (see e.g. C1, L7-10; C2, L 11-16, C4, L51-56; C10, L 5-17...).

Comment 2 : in **D1**, a "further embodiment" (cf. Fig. 10) is shown that uses two sets of interdigitated addressing electrodes. This "further" embodiment differs from the device anticipating present claim 1 and sketched Figs. 7-9.

Comment 3 : in **D1**, column 8, lines 53-56 merely states that Figs. 7&8 show one array of the rectangular pixels of the modulator, each pixel being associated and activated by its corresponding electrode 15.

Comment 4 : Fig. 9 in **D1** shows a specific value of tilt for each portion of LC (see 40-42) associated with an electrode (15) (cf. also column 10, lines 28-39).

Comment 5 : in **D1**, the fixed pitch grating (i.e the electrode - electrode distance) allows, in use, the modulator to vary the deflection angle of incident light for the same reason that the present optical device deflects the light with also a fixed pitch grating {cf. "1 pixel" distance in Fig. 5 in the present application}.

**2.2 The following additional features are also present in D1:-**

- \* the liquid crystal is a nematic crystal layer (col. 7, line 13) {**claim 4**};
- \* the LC layer is a PI cell (cf. Fig. 16 and col. 13, lines 17-26) {**claim 5**};

Therefore, the subject matter of claims 4 and 5 lacks novelty.

**2.3 Similar arguments as those mentioned in §2.1, above, apply also for the subject matter of method claim 12/11 (cf. §7.3 below), which, therefore, is also not novel.**

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**3. Objections according to Article 33(3) PCT - Lack of inventive step.**

**3.1 Document D2 is now considered. D2 discloses in an example not drawn (see first example, col. 2, lines 7-17) an optical switch with two SLMs (this switch in D2 is the two SLMs version of the second example having the folded layout drawn in Fig. 4).**



This switch comprises input and output optical fibres (col. 2, lines 27-32), two SLMs (col. 2, lines 12-17) onto which holograms are addressed for coupling selected inputs to selected outputs (col. 1, lines 62-67 and col. 5, lines 43-51).

Although the SLMs used in **D2** are already polarisation insensitive (see the abstract), it would have been advantageous for the skilled person to replace **D2**'s transmissive SLM with the reflective SLM disclosed in **D1**, because of the generally greater integration (through a better filling factor) achieved by reflective SLMs.

Such a combination would therefore led the skilled person to achieve the subject matter of **claim 2** without the exercise of inventive skill.

- 
4. The additional feature of **claim 3** that input and output optical fibers are off-normally directed on respective SLM is not present in the prior art to hand. Furthermore, no motivations can be found in the available prior art to add this feature.

As to the subject matter of **claim 6** when made dependent of claim 2, the addition of a half wave plate between the SLMs is also not present in and cannot be hinted at from the prior art to hand.

Therefore, the subject matter of claims 3-10/10, 11/10 (cf. §7.3 below) fulfils the requirements of Articles 33(2) and 33(3), PCT.

- 
5. The industrial applicability (Article 33(4) PCT) is clearly present for the subject matter of all the claims.
-

**Re Item VII**

**Certain defects in the international application**

- 6.1 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
- 6.3 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the cited documents is not mentioned in the description, nor are these document identified therein.
- 6.4 The description is not clear in the following respect :-
- \* In the description (cf. p. 20..) the "second lens" is referenced 151 although in Figs. 9 & 10 it is referenced 152; and,
  - \* In the description (cf. p. 21..) the reference number 153 (corresponding to the microlens array) does not have any counterpart in the drawings.

**Re Item VIII**

**Certain observations on the international application**

The following claims do not meet the requirement of Article 6 PCT in that the subject matter for which protection is sought lacks clarity, conciseness or is not fully supported by the description:-

- 7.1 Although claims 1 and 2 are related to an optical device, the last expression of each claim refers to a reconfigurable routing device which routing device hints at multiple input / output ports not stated in these claims. This inconsistency renders the nature of claimed object unclear and these expressions have not been taken into account in this report.
- 7.2 In both independent claims, it has been assumed that the optical retardance is of  $(2n+1)\lambda/4$ .
- 7.3 It appears that a numbering error is present in the present set of claims (claim 10 is present twice). Therefore, in this report, the last three claims are referenced 10/10, 11/10, and 12/11.

## Claims

1. An optical device comprising an integrated multiphase spatial light modulator for spatial phase modulation of unpolarised light of a predetermined wavelength, the modulator comprising a substantially planar liquid crystal layer, a layer reflective of said light of said wavelength and a wave-plate layer providing an optical retardance of  $(2n+1)/4$ , wherein said liquid crystal layer has two opposed faces and is disposed and configured to provide an out of plane tilt in response to a voltage applied between said faces and wherein said liquid crystal layer is spaced from the reflective layer by said wave-plate layer, the spatial light modulator comprising an integrated array of phase modulating elements and voltage application circuitry for applying desired voltages across the liquid crystal layer whereby the liquid crystal layer has desired values of out of plane tilt; **characterised in that :**

the modulator comprises an array of electrodes, each of the electrodes being associated with a respective portion of the liquid crystal layer to define a said phase modulating element, the electrodes being such that application of voltage to each electrode causes the portion of the liquid crystal layer associated with the said electrode to have a specific value of said out-of-plane tilt; and:

the voltage application circuitry is adapted to apply voltages to said array of electrodes for varying a deflection angle of said light whereby said optical device is a reconfigurable routing device.

2. An optical device according to claim 1, wherein said integrated multiphase spatial light modulator is a first SLM and further comprising a second said integrated multiphase spatial light modulator disposed with respect to the first SLM so as to be capable of receiving light from said first SLM to form a reconfigurable routing device.

3. An optical device according to claim 2, having a first array of optical fibres forming light sources directed to be off-normally incident on the first SLM and a second array of optical fibres forming light receivers directed to be off-normally incident on the second integrated multiphase spatial light modulator for receiving light from the second integrated multiphase spatial light modulator.

4. An optical device according to any preceeding claim, wherein said liquid crystal layer is a nematic liquid crystal layer.
5. An optical device according to any one of Claims 1 - 3, wherein said liquid crystal layer is a pi-cell.
6. An optical device according to Claim 2 or 3, in which a half wave plate is disposed between said first and second spatial light modulators.
7. A routing switch comprising an optical device according to Claim 3, and drive circuitry for forming a respective plurality of switching holograms on each spatial light modulator, each switching hologram on said first spatial light modulator in use being operative to deflect light incident on said first spatial light modulator to said switching holograms on said second spatial light modulator, and each said switching hologram on said second spatial light modulator in use being operative to deflect said light beams to a respective optical reciever.
8. A routing switch according to Claim 7, wherein the switching holograms are spaced apart on said first and second spatial light modulators and the first and second spatial light modulators are disposed such that a respective zero-order beam reflected from each switching hologram on said first spatial light modulator is incident on a spacing between two adjacent switching holograms on said second spatial light modulator.
9. A routing switch according to Claim 8, wherein a half wave plate is disposed between said first and second spatial light modulators.
10. A routing switch according to Claim 7, wherein the first and second spatial light modulators are mutually offset so no zero-order beams from the first spatial light modulator are incident on the second spatial light modulator.
10. A routing switch according to Claim 7, wherein the switching holograms are spaced apart on said first and second spatial light modulators, and the first

and second spatial light modulators are disposed such that a respective second-order beam from each switching hologram on said first spatial light modulator is incident on a space between two adjacent switching holograms on said second spatial light modulator.

11. A method of routing a light beam having a first component polarised in a first direction and a second component polarised in a second direction orthogonal to the first, the method comprising:

providing an integrated SLM comprising a liquid crystal layer, a wave plate layer having an optical retardance of  $(2n+1)/4$  and a reflector layer, the liquid crystal being responsive to a variation in a drive voltage to provide a variation in out-of-plane director angle tilt, the SLM having an array of electrodes wherein each electrode is associated with a respective portion of the liquid crystal layer to define a phase modulating element whereby the SLM comprises an array of phase modulating elements;

applying a respective drive voltages to each said electrode whereby the portion of liquid crystal associated with the electrode has a respective specific value of director angle tilt;

applying said beam to the integrated SLM whereby the first and second components each pass through the liquid crystal layer and the wave plate layer, and are reflected at the reflector layer to again pass through the wave plate layer and liquid crystal layer to emerge with both components phase modulated by the same amount; and

controlling the drive voltages to vary a deflection of said light beam due to said array of phase modulating elements.

## Claims

1. An optical device comprising an integrated multiphase spatial light modulator for spatial phase modulation of unpolarised light of a predetermined wavelength, the modulator comprising a substantially planar liquid crystal layer, a layer reflective of said light of said wavelength and a wave-plate layer providing an optical retardance of  $(2n+1)/4$ , wherein said liquid crystal layer has two opposed faces and is disposed and configured to provide an out of plane tilt in response to a voltage applied between said faces and wherein said liquid crystal layer is spaced from the reflective layer by said wave-plate layer, the spatial light modulator comprising an integrated array of phase modulating elements and voltage application circuitry for applying desired voltages across the liquid crystal layer whereby the liquid crystal layer has desired values of out of plane tilt;

**characterised in that :**

the modulator comprises an array of electrodes, each of the electrodes being associated with a respective portion of the liquid crystal layer to define a said phase modulating element, the electrodes being such that application of voltage to each electrode causes the portion of the liquid crystal layer associated with the said electrode to have a specific value of said out-of-plane tilt; and:  
the voltage application circuitry is adapted to apply voltages to said array of electrodes for varying a deflection angle of said light whereby said optical device is a reconfigurable routing device.

2. An optical device according to claim 1, wherein said integrated multiphase spatial light modulator is a first SLM and further comprising a second said integrated multiphase spatial light modulator disposed with respect to the first SLM so as to be capable of receiving light from said first SLM to form a reconfigurable routing device.

3. An optical device according to claim 2, having a first array of optical fibres forming light sources directed to be off-normally incident on the first SLM and a second array of optical fibres forming light receivers directed to be off-normally incident on the second integrated multiphase spatial light modulator for receiving light from the second integrated multiphase spatial light modulator.

4. An optical device according to any preceeding claim, wherein said liquid crystal layer is a nematic liquid crystal layer.
5. An optical device according to any one of Claims 1 - 3, wherein said liquid crystal layer is a pi-cell.
6. An optical device according to Claim 2 or 3, in which a half wave plate is disposed between said first and second spatial light modulators.
7. A routing switch comprising an optical device according to Claim 3, and drive circuitry for forming a respective plurality of switching holograms on each spatial light modulator, each switching hologram on said first spatial light modulator in use being operative to deflect light incident on said first spatial light modulator to said switching holograms on said second spatial light modulator, and each said switching hologram on said second spatial light modulator in use being operative to deflect said light beams to a respective optical reciever.
8. A routing switch according to Claim 7, wherein the switching holograms are spaced apart on said first and second spatial light modulators and the first and second spatial light modulators are disposed such that a respective zero-order beam reflected from each switching hologram on said first spatial light modulator is incident on a spacing between two adjacent switching holograms on said second spatial light modulator.
9. A routing switch according to Claim 8, wherein a half wave plate is disposed between said first and second spatial light modulators.
10. A routing switch according to Claim 7, wherein the first and second spatial light modulators are mutually offset so no zero-order beams from the first spatial light modulator are incident on the second spatial light modulator.
10. A routing switch according to Claim 7, wherein the switching holograms are spaced apart on said first and second spatial light modulators, and the first

and second spatial light modulators are disposed such that a respective second-order beam from each switching hologram on said first spatial light modulator is incident on a space between two adjacent switching holograms on said second spatial light modulator.

11. A method of routing a light beam having a first component polarised in a first direction and a second component polarised in a second direction orthogonal to the first, the method comprising:
  - providing an integrated SLM comprising a liquid crystal layer, a wave plate layer having an optical retardance of  $(2n+1)/4$  and a reflector layer, the liquid crystal being responsive to a variation in a drive voltage to provide a variation in out-of-plane director angle tilt, the SLM having an array of electrodes wherein each electrode is associated with a respective portion of the liquid crystal layer to define a phase modulating element whereby the SLM comprises an array of phase modulating elements;
  - applying a respective drive voltages to each said electrode whereby the portion of liquid crystal associated with the electrode has a respective specific value of director angle tilt;
  - applying said beam to the integrated SLM whereby the first and second components each pass through the liquid crystal layer and the wave plate layer, and are reflected at the reflector layer to again pass through the wave plate layer and liquid crystal layer to emerge with both components phase modulated by the same amount; and
  - controlling the drive voltages to vary a deflection of said light beam due to said array of phase modulating elements.



From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

NEOBARD, William, John  
W.H. Beck, Greener & Co.,  
7 Stone Buildings  
London WC2A 3SZ  
GRANDE BRETAGNE

PCT

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT  
(PCT Rule 71.1)

Date of mailing  
(day/month/year) 13.12.2001

Applicant's or agent's file reference  
102970/PDJ

IMPORTANT NOTIFICATION

International application No.  
PCT/GB00/03796

International filing date (day/month/year)  
04/10/2000

Priority date (day/month/year)  
04/10/1999

Applicant  
THOMAS SWAN & CO. LTD. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/

 European Patent Office  
D-80298 Munich  
Tel. +49 89 2399 - 0 Tx: 523656 epmu d  
Fax: +49 89 2399 - 4465

Authorized officer

DEL FRATE, A

Tel. +49 89 2399-7038



PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>102970/WJN</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 00/ 03796</b>	International filing date (day/month/year) <b>04/10/2000</b>	(Earliest) Priority Date (day/month/year) <b>04/10/1999</b>
Applicant  <b>THOMAS SWAN &amp; CO. LTD. et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

8

☐ None of the figures.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/03796

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G02F1/1335 G02F1/139 G02F1/31 G02B5/32 G03H1/08

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G02F G02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, PAJ, IBM-TDB, EPO-Internal, INSPEC, COMPENDEX

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	G.D.GORDON: "LIQUID-CRYSTAL PHASE MODULATOR FOR UNPOLARIZED LIGHT" APPLIED OPTICS, vol. 32, no. 13, 1 May 1993 (1993-05-01), pages 2222-2223, XP000362787	1,2,4,5, 7,8,10, 11,13-16
A	the whole document	17
X	EP 0 878 729 A (SHARP KK) 18 November 1998 (1998-11-18)	1-5,7-16
A	column 1, line 1 -column 3, line 35 column 5, line 20 -column 7, line 38 column 8, line 53 -column 10, line 39 column 12, line 13 - line 18; figures 7-9	17
A	US 5 930 012 A (MEARS ROBERT JOSEPH ET AL) 27 July 1999 (1999-07-27)	17,18, 22-24, 27,28
	the whole document	

-/--

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*&\* document member of the same patent family

Date of the actual completion of the international search

18 December 2000

Date of mailing of the international search report

28/12/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Stang, I

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/88 00/03796

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 159 473 A (FELDMAN MICHAEL R) 27 October 1992 (1992-10-27) column 10, line 44 -column 11, line 21 column 6, line 17 -column 7, line 52; figures 1,5 -----	1,7,14, 17-19,21

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/03796

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0878729 A	18-11-1998	GB 2325056 A	11-11-1998
		JP 10311975 A	24-11-1998
		US 5973817 A	26-10-1999
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US 5930012 A	27-07-1999	AU 3573195 A	26-04-1996
		AU 3573295 A	26-04-1996
		DE 69515889 D	27-04-2000
		DE 69515889 T	07-12-2000
		EP 0783713 A	16-07-1997
		EP 0783724 A	16-07-1997
		WO 9610762 A	11-04-1996
		WO 9610776 A	11-04-1996
		US 6141361 A	31-10-2000
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US 5159473 A	27-10-1992	WO 9215906 A	17-09-1992
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